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| 10/518,755 | 08/01/2005 | Tatsuya Uchida | 2004_2020A | 2872 |

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WENDEROTH, LIND & PONACK, L.L.P.
2033 K STREET N. W.
SUITE 800
WASHINGTON, DC 20006-1021

| EXAMINER | |
|---|---|
| BOYER, RANDY | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/518,755 | UCHIDA ET AL. | |
| | Examiner | Art Unit | |
| | Randy Boyer | 1797 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *21 December 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *21 December 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. Claims 1 and 2 are rejected under 35 U.S.C. 102(a) as being anticipated by Lin (V.S.-Y. Lin et al., *Molecular Recognition Inside of Multifunctionalized Mesoprous Silicas: Toward Selective Fluorescence Detection of Dopamine and Glucosamine*, 123 J. AM. CHEM. SOC. 11510-11511 (2001)). Alternatively, claims 1 and 2 are rejected under 35 U.S.C. 102(a) as being anticipated by Lin (V.S.-Y. Lin et al., *Molecular Recognition Inside of Multifunctionalized Mesoprous Silicas: Toward Selective Fluorescence Detection of Dopamine and Glucosamine*, 123 J. AM. CHEM. SOC. 11510-11511 (2001)), as evidenced by Kresge (C.T. Kresge et al., *Ordered Mesoporous Molecular Sieves Synthesized by a Liquid-Crystal Template Mechanism*, 359 NATURE 710-712 (1992)).

3. With respect to claim 1, Lin discloses a fluorescent channel sensor (see Lin, Figure 1) which is a nanochannel sensor (i.e. formed from a mesoporous silica material), wherein the presence of a target substance (e.g. dopamine, glucosamine) in a sample solution is detected with fluorescence intensity provided by recognition of a

target substance with a fluorescent recognition reagent in the nanochannels (see Lin, Figure 1 and accompanying text; and Figure 2 and accompanying text).

Examiner notes that Lin does not explicitly disclose wherein the nanochannel sensor has a nanochannel thin film in which oxide layers have surfactant micelles therein. However, Kresge explains the formation mechanism for MCM-41 mesoporous silicas (i.e. the identical material used to form the nanochannel sensor of Lin) (see Kresge, Fig. 5 and accompanying text). Kresge explains the process as "liquid-crystal templating" whereby cylindrical micelles form a "template" which are then calcined, leaving behind inorganic (i.e. oxide) material (see Kresge, Fig. 5). In this regard, Examiner notes that Lin describes the same "surfactant templated" formation mechanism for forming his nanochannel sensor (see Lin, page 11510).

Therefore, because Lin uses the identical process described by Kresge for forming his nanochannel sensor, Lin's nanochannel sensor inherently and necessarily has "a nanochannel thin film in which oxide layers have surfactant micelles therein."

4. With respect to claim 2, Lin discloses wherein the nanochannel sensor is formed from silica (see Lin, entire disclosure).

### *Claim Rejections - 35 USC § 103*

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which

said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 3-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin (V.S.-Y. Lin et al., *Molecular Recognition Inside of Multifunctionalized Mesoprous Silicas: Toward Selective Fluorescence Detection of Dopamine and Glucosamine*, 123 J. AM. CHEM. SOC. 11510-11511 (2001)) in view of Hernandez (R. Hernandez et al., *Controlled Placement of Luminescent Molecules and Polymers in Mesostructured Sol-Gel Thin Films*, 123 J. AM. CHEM. SOC. 1248-1249 (2001)).

9. With respect to claims 3 and 5, Lin discloses a fluorescent channel sensor (see Lin, Figure 1) which is a nanochannel sensor (i.e. formed from a mesoporous silica material) having a nanochannel thin film in which oxide layers have surfactant micelles therein (see discussion *supra* at paragraph 3), wherein the presence of a target substance (e.g. dopamine, glucosamine) in a sample solution is detected with fluorescence intensity provided by recognition of a target substance with a fluorescent recognition reagent in the nanochannels (see Lin, Figure 1 and accompanying text; and Figure 2 and accompanying text).

Lin does not disclose wherein the fluorescent recognition reagent and the sample solution are mixed, and the fluorescent recognition reagent and the target substance recognized therewith are extractively trapped in the nanochannels.

However, Hernandez discloses three distinct one-step formation mechanisms for forming mesoporous silica thin films wherein desired molecules (e.g. fluorescent recognition reagents) may be placed in specified regions of the mesostructure (see Hernandez, page 1248). In a first method, Hernandez describes the addition of a fluorescent functionality ($Eu^{3+}$) to the mesostructure which acts as a building block of the silicate framework (see Hernandez, page 1248). Hernandez explains that such a mesoporous thin film can be formed by mixing the fluorescent recognition reagent ($Eu^{3+}$) and the silicate precursor solution (see Hernandez, footnote 28 and accompanying text). Hernandez further explains that her method(s) of forming mesoporous thin films provides benefits over other formation mechanisms such as post-doping techniques (i.e. such as that described by Lin) (see Hernandez, page 1248).

Hernandez explains that the post-doping techniques of functionalizing mesoporous thin films have inherent limitations because the dopants (e.g. fluorescent recognition reagents) can only be loaded and localized in the empty pores of the mesostructure, and are thus governed by diffusion (see Hernandez, page 1248). In this regard, Lin notes such a limitation with his own sensor wherein he attributes a very slow response time for glucosamine detection to slow diffusion rates of glucosamine through the pores (see Lin, Figure 2b and accompanying text).

Therefore, the person having ordinary skill in the art of fluorescent nanochannel sensors would have been motivated to modify the sensor of Lin by forming the sensor's mesoporous structure using the formation mechanism of Hernandez in order to overcome the diffusion limitations associated with Lin's post-doping technique for incorporating fluorescent functionalities into the thin film.

Finally, the person having ordinary skill in the art of fluorescent nanochannel sensors would have had a reasonable expectation of success in forming the sensor of Lin using the formation mechanism of Hernandez because (1) both Lin and Hernandez use the same MCM-41 mesoporous silica material for forming mesoporous thin films; and (2) Hernandez explicitly discloses use of her method for incorporating fluorescent functionalities (e.g. those that would be used in the sensing applications of Lin) into the framework of the silicate mesostructure.

10. With respect to claims 4 and 6, Hernandez discloses wherein the nanochannels of the silica mesostructure may be impregnated with a fluorescent recognition reagent (e.g. ruthenium (II)) (see Hernandez, footnote 34 and accompanying text).

***Conclusion***

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Randy Boyer whose telephone number is (571) 272-7113. The examiner can normally be reached Monday through Friday from 10:00 A.M. to 7:00 P.M. (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn A. Caldarola, can be reached at (571) 272-1444. The fax number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

RPB

Glenn Caldarola
Supervisory Patent Examiner
Technology Center 1700